

## GENETIC CHANGES IN WHITE AND BLACK PEOPLE

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The movement of a large part of the world population from Europe, Africa, and Asia to the "melting pot" of America gradually has produced genetic changes in the present population. A considerable number of these individuals were black slaves, and since their arrival in this country, an intermingling of white and black races has occurred. In some estimates, a large share of the black population, perhaps as much as 70%, was thought to have some white ancestry. These opinions were not based on laboratory examinations, however, and not until the discovery of the Duffy antigens did a method exist to define the races more precisely.

The degree of admixture of blacks and whites has been studied in various ways on previous occasions. In 1953, Glass and Li,<sup>1</sup> on the basis of ABO and Rhesus blood groups and phenylthiocarbamide testing, estimated the accumulated white genes in American blacks to be 31%. Stern<sup>2</sup> suggested a figure to 30%, and Roberts<sup>3</sup> suggested one of 20%. In a later presentation, Glass<sup>4</sup> revised his estimate to 21%.

The Duffy antigens were originally studied because of their association with transfusion reactions and immunological disorders. The discovery was then made that white people always have a positive reaction and blacks exhibit a negative unless intermixture has occurred.

Investigation has been concentrated mainly on the flow of genes from white to black with relatively little attention being given to the reverse flow except in the sickle cell disorder. This change in hemoglobin is usually found in individuals of African, Mediterranean, Indian, and Middle East origin. Starting in Africa, the disease probably spread to people ringing the Mediterranean Sea as a result of intermixture. The appearance of sickle cell disease in pure white stock has been

extremely rare but a scan of the present-day literature indicates that it is not being recognized in the white population to a greater extent than previously. Many whites may be the unconscious bearers of some black genetic traits.

Although sickle cell disease may seem relatively uncommon in Baltimore, it exists in greater number than may be currently appreciated.<sup>5</sup> An electrophoretic screening study of 39 510 blacks in Baltimore uncovered 36 with sickle cell disease (0.09%) and 3100 with the trait (7.85%). If the entire black population (434 000) is considered, the suggestion may be advanced that 400 individuals have sickle cell disease and 34 000 have the trait.

The study of Duffy blood proteins in 722 blacks in the same area has related interest.<sup>6</sup> This method is the best way now known to differentiate the black and white races. These proteins appeared in 36.28% of the blacks tested. Extrapolation of these numbers to the current black population of Baltimore may be mathematically hazardous but is, nevertheless, interesting. More than 157 000 of these individuals might have a positive Duffy reaction.

The mean frequency of the gene producing the Duffy reaction may be estimated at about 0.0200 in all West Africans at the time of the slave trade. The same frequency in present-day black Baltimoreans is 0.2018. Allowing for the elapse of 12 generations since slaves first arrived in America, the average change per generation is 0.01515. Computation suggests that in 12 more generations, the genetic value will be 0.2427.

This test measures the transfer of a white gene to a black individual. Assuredly, other genes may be transferred at the same time. Indeed, the precise ethnic composition of American blacks in general may be difficult to determine because studies of localized areas will display only the degree of white ancestry at those particular sites.

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Certain other observations about the Duffy proteins are interesting:

- The geneticists have located the Duffy gene on chromosome one on the opposite side of the centromere from the Rh factor.<sup>7</sup> Linkage of these two genes is thus possible. In a study of 614 randomly selected blacks, mitotic movement of these genes was demonstrated within the limits of experimental error.<sup>8</sup>
- Marked increases have occurred in the incidence of cancer at many anatomic sites in Baltimore blacks. Petrakis<sup>9</sup> has suggested that the incidence of carcinoma of the breast in black women parallels the genetic white mixture that has occurred. Using the data found in the Duffy investigation, a positive relationship between carcinoma in general and a positive Duffy reaction could not be established.<sup>10</sup>
- Reid et al<sup>11</sup> suggested a greater incidence of positive reactions in Baltimore blacks with cirrhosis of the liver. This result, however, was not substantiated by a study of two groups of black patients: 43 with alcoholism and alcoholic liver disease, and 47 with severe alcoholism without liver involvement.<sup>12</sup>
- A most positive result of the Duffy investigations was the demonstration of a direct correlation between a negative Duffy reaction and resistance to certain strains of malaria, a disease that has influenced population genetics. People in the endemic area who have sickle cell disease or trait have a survival advantage over those with normal hemoglobin as far as certain types of malaria are concerned. Miller et al<sup>13</sup> first proposed that the Duffy-negative group was the basis for resistance of blacks to *Plasmodium vivax*. Removal of the blood group determinant by proteolytic digestion or blockage by specific antisera in vitro resulted in resistance to invasion by *P. vivax*.<sup>14</sup> Gerald<sup>15</sup> acclaimed the demonstration with the hope that it would increase understanding of infectious disease in general. The work later was substantiated by the study of a group of 13 blacks who had contracted vivax malaria in Vietnam.<sup>16</sup> All were found to be Duffy positive.
- In a comparison of two hospitals in Baltimore, one with a predominantly black population and one with a white, the incidence of diabetes mellitus of some type was noted to be greater in the white group.<sup>17</sup> Studies of the Duffy proteins were undertaken in the blacks to assay their role in glucose metabolism as effected by hybridization. The demonstration that such a disturbance occurred more often in blacks suggested that black people with a positive Duffy reaction be investigated to corroborate the premise that the inci-

dence of diabetes mellitus might be less in that group. Thirty-two black patients with trouble with glucose metabolism had positive Duffy reactions. This set was contrasted with 43 patients with diabetes mellitus and a negative Duffy response. Duffy-positive patients were determined to have a slightly greater propensity to having a glucose disturbance, in opposition to the premise being investigated.

The genetic polymorphic differences between the red blood cells of blacks and whites yield in most instances an adaptive advantage. Roth<sup>18</sup> has suggested that other genetic changes have been made in Africans. The elimination of these undesirable genes may not yet have occurred in whites, and if serious morbidity is to be associated with the trait, it might well be found in whites. Certainly, the incidence of splenic infarction in white people at moderately high altitudes may serve as a warning to the medical practitioner to be alert to the untoward effects that the "benign" trait may produce in white individuals.

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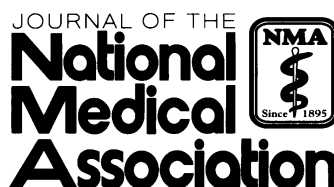
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